

Remarks

Thorough examination by the Examiner is noted and appreciated.

The Specification has been amended to correct grammatical errors.

The claims have been amended and new claims added to clarify Applicants disclosed and claimed invention. The amendments find support in the original claims and/or the Specification. No new matter has been added. For example, support for amendments including claims 1, 10, 14, 18 and new claim 24 is found in the original claims as well as the Specification at paragraph 0022 on page 12 and in Figure 1C:

"For example, during at least the initial period of the first CVD deposition process, preferably the substantial part of the deposition occurs in an upper portion of the via to **create a keyhole effect thereby closing off and sealing the upper portion of the via.**"

Claim Rejections under 35 USC 102

1. Claims 1-6 and 11-13 stand rejected under 35 USC Section 102(e) as being anticipated by Ohuchi et al. (US 6,576,562).

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Ohuchi et al. disclose a method for forming an etched opening in a substrate using a mask material including a carbon content of 80% or more (see Abstract). The relevant portions of Ohuchi et al. disclose a bi or tri-layer process for patterning and etching a dual damascene structure are included in Figures 7A through 7F (sixth embodiment beginning at col 23, line 13). Ohuchi et al. disclose and teach a method for forming an etched opening e.g., a dual damascene using a tri-layer methodology (e.g., col 23, lines 49-52) or a bi-layer methodology (e.g., col 29, lines 13-20). In both cases the upper layer is a silicon containing resist layer which is first wet developed followed by dry developing a lower organic base layer having a carbon content of disclosed to be greater than about 90% to provide an increased etching resistance (e.g., col 24, lines 11-54, col 29, lines 33-34), and then using the organic base layer as an etching mask to etch the via and trench openings.

Specifically, following formation of the via opening, the upper resist layer is removed during dry developing the lower organic film (see item 209 in Figure 7A; col 26, lines 33-35) and the intermediate silicon oxide organic layer (see item 208 in Figure 7A) is removed during the via etching process to leave the lower organic base layer as the etching mask (see item 207 in Figure 7B; col 6, lines 40-49).

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Following etching of the via opening, the remaining organic base film mask (item 207 in Figures 7B and 7C) is coated with a second organic base film (item 211 in Figure 7C) made of the same material as the first organic base film mask (item 207) i.e., also having a carbon content of greater than 90% (see col 26, lines 64-67), to fill the via opening. The second organic base film (item 211) is formed by a spin coating process to **fill** the via opening (col 27, lines 9-20). An organic silicon oxide film is then deposited on the organic base film (item 212 in Figure 7c) followed by a photoresist layer (items 213 in Figure 7c).

A patterning process similar to the via patterning process is then followed to pattern a trench etching mask, where the upper photoresist disappears during patterning (dry developing) the two lower organic base films to form the trench etching mask(items 211, 207) (see col 28, lines 9-13). Following etching of the trench opening, the remaining portions of the organic base layers on the process surface and within the via opening are removed (see col 28, lines 47-54; Figures 7D an 7E) **by an oxygen ashing process** where the **via opening portion is exposed to the oxygen ashing** process.

Thus, Ohuchi et al. do not teach or disclose several elements of Applicants claimed invention including:

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"depositing a **first dielectric layer stack** layer comprising at least one dielectric layer over the at least one dielectric insulating layer to seal the via opening"

Rather, Ohuchi et al. disclose depositing a second **organic base layer on top of a first organic base layer** present on the surface **to fill the via opening.**

Ohuchi et al. also do not teach or disclose:

"blanket depositing a second **dielectric layer stack** comprising at least one dielectric layer to form a hardmask over and contacting the first dielectric layer stack"

Ouchi et al. also do not teach or disclose:

"photolithographically patterning and reactive ion etching through a thickness of the hardmask and the first dielectric layer stack to form a trench opening etching pattern overlying and encompassing the via opening while leaving the via opening sealed"

Finally, most importantly, Ohuchi et al. do not disclose:

"removing the photoresist layer according to an ashing process with the via opening sealed"

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Rather Ohuchi et al. teach that the photoresist is removed **during dry developing of the lower organic base layers.** In addition, following etching the trench opening, the remaining portion of the organic base layer (a similar material to the photoresist) is **removed by an ashing process** thereby exposing the via opening to the ashing process. Thus, Ohuchi et al. is clearly insufficient to anticipate Applicants disclosed and claimed invention.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Claim Rejections under 35 USC 103

1. Claims 7, 10, 14-18 and 20-23 stand rejected under 35 USC Section 103(a) as being unpatentable over Ohuchi et al., above, in view of Liu et al. (US 6,323,121).

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Applicants reiterate the comments made above with respect to Ohuchi et al.

In addition, Applicants point out that the method of Ohuchi et al. works by a different principal of operation that would defeat the purpose and benefits of Applicants disclosed and claimed invention. For example, Ohuchi et al. teach removing a remaining portion of the organic base layer filling the via following the trench etching process by **carrying out an ashing process** which thereby exposes the via to the ashing process and defeats the solution to a problem that Applicants have recognized and provided by their disclosed and claimed invention.

Applicants note that Examiner is mistaken in asserting that Ohuchi et al. disclose forming a first and second dielectric layer stacks as Applicants have disclosed and claimed. Ohuchi et al. disclose forming a **lower organic base film** having a carbon content of greater than 90% (**not a dielectric layer stack**) and an overlying layer of spin on glass (SOG) layer (**organic** silicon oxide) (items 211, 212; Figure 7C) as explained at column 27, lines 3-5; and at lines 26-30.

On the other hand, Liu et al. **discloses an ashing method including oxygen for removing polymer deposits from an etched via**

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or trench opening following via or damascene etching (see Abstract), thereby **exposing the via opening to the ashing process** and likewise defeating the solution that Applicants have provided by their disclosed and claimed invention.

Assuming arguendo, a proper motivation for combining the teachings of Liu et al. and Ohuchi et al., which Applicants do not concede, such combination fails to produce Applicants disclosed and claimed invention, and further, defeats the purpose and solution to the problem that Applicants have recognized and solved by their disclosed and claimed invention. Both Ohuchi et al. and Liu et al., alone or in combination, teach directly away from Applicants disclosed and claimed invention. Ohuchi et al. and Liu et al., alone or in combination, thereby fail to make out a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

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"A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997).

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc.*, 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), cert denied, 469 U.S. 851 (1984).

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that

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necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,
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